CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Joanna B. Alday

Project Number
S0801

Project Title
The Chemical Adaptations of Marine Algae in Stressed Environments

Abstract

Objectives/Goals
The objective of my experiment is to identify and contras adapted chemical components of the same species of algae in environmentally different areas. The algae samples were taken from areas that were of stressed/polluted surroundings and areas that were clean and uninhabited.

Methods/Materials
In order to find the chemical components of the algae a method called Thin Layer Chromatography(TLC) was used. The seven algae samples were massed out equally and chemically extracted with ethyl acetate. After 48 hours the extracted liquid was then transferred into epitubes and spun in a micro-centrifuge. A depth of less than 0.5 Ethyl acetate was poured into a chromatography tank. On a TLC plate a line was carefully drawn 0.5 cm above the bottom. The TLC plate was then spotted 7 times by each individual algae and was then placed in the chromatography tank. Using a program called NIH image processing the TLC plate was analyzed

Results
Taken from the bay area, 7 algae samples were found in 5 different locations, 3 of which were polluted and 2 were clean. When analyzed the 7 samples contained 19 chemical compounds. Within these 19 chemical compounds 6 compounds were found to be unrelated to any other components. The different components were usually found in areas that were stressed. This signifies that chemical adaptations must have been made by the algae in order to survive in a polluted environment

Conclusions/Discussion
Thin layer chromatography is just the first step of an expanded experiment. If chemical adaptations were to occur between one species of algae in two environmentally different locations, the change may be substantial enough for the plant to possess medicinal benefits.

Summary Statement
In order to identify the chemical adaptations of algae in stressed environments a method called Thin Layer Chromatography is used to analyze each separate components in a sample.

Help Received
Mr. Okuda applied destructive spray; Grandfather aided in finding algae

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Karen B. Cannon

Project Number
S0802

Project Title
What Is the Most Commonly Found Litter on the Beach?

Abstract

Objectives/Goals
My goal for this project was to find out what litter is most commonly found on the beach and where it comes from so in the future we can stop it from happening, clean it up, and have a beautiful beach.

Methods/Materials
I choose a plot of land 150' by 150' and every Sunday I went down to the beach to pick up all the trash I could find in that section. I plotted my findings on a piece of paper marking down where I found the paper, plastic, glass, styrofoam, cigarettes, aluminum or other.

Results
Plastic, a non-biodegradable substance, on average over an eight week period was 35.62 items per visit. Cigarettes was 35.25 items per visit. Styrofoam was 17.75 items per visit. Aluminum was 12.0 items per visit. Paper, a biodegradable substance, was 2.375 items per visit. Glass was .75 items per visit. Other substances (that didn't fit into these categories) average was 2.875 items per visit.

Conclusions/Discussion
My hypothesis for this project was that cigarettes would be the most commonly found litter on the beach. For a while I was correct. During the fall weeks of my project, the beach was filled with cigarettes but when winter rolled around there were very few. This makes me conclude that there are more smokers on the beach during the fall. My hypothesis was wrong. The average amount of plastic over the long eight weeks was higher than that of the cigarettes.

So if the county were to focus on cleaning up the beach they should concentrate on plastic because it's not biodegradable. In order to correct the litter problem I would find out where the litter is coming from. This would include people walking on the beach, litter when it rains that feed to the ocean from the J street canal, and from boats and oil platforms.

Summary Statement
Finding out what the most common kind of litter was on the beach so we will know what to concentrate on cleaning up.

Help Received
I bribed my sister to help me pick up trash. My Daddy helped me pick up trash too.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Rosalind N. Cox

Project Number
S0803

Project Title
The Teichert Ponds: Chico's Dirty Little Secret

Abstract

Objectives/Goals
The basis of this project was to determine if runoff pollution entering the Chico Teichert Ponds (a city owned storm water/runoff holding facility), as proven in last years project, was migrating into an adjacent freshwater seasonal creek, Little Chico Creek.

Methods/Materials
I tested water from 5 sites in the Teichert Ponds and Little Chico Creek using the LaMotte Water Pollution Detection Outfit-Model AM-21. Site 1 was in the inlet ditch into which the water from the storm drains flows into the ponds. Site 2 was on the west side of the south pond. Site 3 was at the north end of the ponds where the water flows into L. Chico Creek. Site 4 was located in L. Chico Creek above where the water enters from the ponds through an open storm drain. Site 5 was also in L. Chico Creek below where the water from the ponds flows into the creek. I also collected benthic organisms using a dip net at Sites 4 (above) and 5 (below) in L. Chico Creek to test for long term or previous pollution. All dissolved oxygen tests were run in the field; all other tests in my kitchen.

Results
Pollutants were found in the Teichert Ponds at Site 1, but not in L. Chico Creek. Nitrate was present in all water tests as shown in tables and graphs, Samples A, B, and C in conc. of 1-3 ppm. Ammonia Nitrogen was found in Samples B and C in a conc. of 0.5 ppm. Chloride was present in Sample B at a conc. of 1.0 ppm. Phosphate was present in Sample C at a conc. of 1.0 ppm. Dissolved Oxygen, which is not a pollutant, was found at all Sites, 1-5, and all Samples, A-C, at a constant conc. of 4.0 ppm. The pH, which can be an indicator of pollution, was found at 7.0 at all Sites, 1-5, and in all Samples, A-C. The pH was neutral, which does not indicate pollution. There was no significant difference in benthic organisms between Sites 4 and 5 as total numbers of organisms were within 10% of each other.

Conclusions/Discussion
The final analysis indicated that pollution migration had not occurred as both short term and long term pollution was not evident in L. Chico Creek as determined by water analysis and benthic organism analysis respectively. This may prove otherwise through further testing in the warmer months when waters become more concentrated and more pesticides and fertilizers are used. Although no significant pollution was found at this time, I think it would be worthwhile to see if past pollution has entered and accumulated in the food chain.

Summary Statement
This study focuses on identification of possible pollution migration, the first step in developing a solution to the ongoing pollution problem, from the Chico Teichert Ponds, a storm water/runoff holding facility, into a freshwater creek.

Help Received
Dr. Donald Miller of CSU, Chico helped me identify a type of benthic organism, the midge larva (pupa). My Dad drove me to the Teichert Ponds and Little Chico Creek so that I could collect samples, as well as to CSU, Chico, to see Dr. Miller. He also helped me with my backboards.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Sanjit Datta

Project Number
S0804

Project Title
Operational Effects of Altered Abiotic Factors on Nitrifying Bacteria: Year 2

Abstract

Objectives/Goals
A way to easily determine the feasibility of any method of preserving water quality in a specific water body is critical for the large-scale implementation of the method. It has been proven that artificial addition of nitrifying bacteria to a water body can efficiently lower concentrations of ammonia, a highly toxic nutrient. A set of abiotic factors with respect to temperature, pH, salinity, and dissolved oxygen under which the bacteria can be expected to operate optimally would be instrumental in helping naturalists considering adding nitrifying bacteria to a natural water body make the decision whether to implement the system.

Methods/Materials
The experiment was done by changing abiotic factors in tanks containing Nitrobacter and Nitrosomonas and water collected from Salinas de San Pedro, a salt marsh. The success of the bacteria was determined by testing concentrations of ammonia and nitrates. It was hypothesized that only salinity will have an effect on the bacteria and that the other three tested factors will not have an effect.

Results
The results showed that this was incorrect. The two genera of bacteria in the Biozyme favored different conditions of abiotic factors. A higher temperature boosted the operation of Nitrobacter. Salinity had a very large effect on Nitrosomonas, but it barely affected Nitrobacter. Nitrosomonas also preferred a high dissolved oxygen content. Nitrosomonas showed a very small preference for a slightly alkaline environment over a slightly acidic one.

Conclusions/Discussion
Overall, the optimum water body for the nitrifying bacteria to operate in would have a temperature of about 30°C, a pH between 8.0 and 8.3, a salinity between 22 and 27 ppt, and a dissolved oxygen content between 5 and 9 mg/L. It should be noted, however, that in almost all cases, the bacteria operated as it should under unfavorable conditions, although its processes were somewhat delayed.

Summary Statement
I determined the optimum operating conditions with respect to abiotic factors for two genera of nitrifying bacteria.

Help Received
Mother, father, and sister helped make board; Worked at Cabrillo Marine Aquarium under Linda Chilton; Participant in SCAS Research Training Program; Participant in high school research course.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Danielle M. Golden

Project Number

S0805

Project Title

Death of a River: An Analysis of the Concentrations of Urban Contaminants in the Santa Ana River Watershed

Abstract

Objectives/Goals

The objective is to determine whether or not urban contaminants have a negative effect on the health and safety of the Santa Ana River and if pollution increases as one travels along the waterway from Mill Creek in the San Bernardino Mountains to where it flows into the Pacific Ocean at Huntington Beach.

Methods/Materials

Water was sampled from ten specifically chosen locations along the Santa Ana River. Each sample was tested for pH at the location where the water was gathered. The following day, under the supervision of a certified chemist, the samples were also tested for presence/absence of Coliform and fecal Coliform bacteria using M Endo Agar and EC Medium, respectively. The concentrations of the anions chloride, nitrite, nitrate, phosphate, and sulfate were analyzed using Ion Chromatography. Results were then compared to the control, a sample of distilled water.

Results

The water proved to be of the highest quality at the locations nearest to the headwater of the Santa Ana at Mill Creek and water quality deteriorated quickly and significantly as it neared the ocean. More specifically, results of the pH tests proved the water to be generally alkaline, and excluding the first location tested at Mill Creek, bacteria was present everywhere. The concentrations of ions increased overall as the river traveled through city areas.

Conclusions/Discussion

My hypothesis was proven correct. As the water flowed through the urban city areas of the San Bernardino, Riverside, and Orange Counties, contaminants from urban runoff and pollution did indeed accumulate in the Santa Ana River, contaminating the water to an extremely unsafe and unhealthy point.

Summary Statement

The Santa Ana River is indeed contaminated and unsafe, notably deteriorating in quality as it flows through urban areas due to runoff and uncontrolled pollution.

Help Received

I was driven to the locations where I gathered my water samples along the Santa Ana River by my elder cousin. Laboratory testing was done at the Riverside Water Quality Control Plant under the supervision of certified chemist Virginia Godoy. Credit to Greg Dueker of the Santa Ana Project Authority (SAWPA)

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
John M. Horn

Project Number
S0806

Project Title
Destructive Nature of the Urban Jungle

Abstract

Objectives/Goals
The objective of my study was to do determine preventative measures to urban trees destroying nearby sidewalk via root growth. I believe that a combination of large trees, small space to proliferate, and inherit traits of certain species all contribute to uplifted sidewalks.

Methods/Materials
One Hundred fifty trees were measured half consisting of a non-destructive control and the other half were experimental trees that significantly raised the sidewalk. A broad area of San Diego County was surveyed and four different measures were taken for each tree. The point of the tree trunk containing the largest circumference was measured. The angles and lengths of the sidewalk protruding were measured and the volume of displaced soil was calculated. The distance from the tree to the sidewalk was taken as well as pictures of the tree so as to identify its species with the help of the San Diego Forester. After I obtained the species of tree I then looked up its known root potential to damage sidewalk and lastly did a comparative analysis with all my data.

Results
The first hypothesis that tree size affected how much soil was displaced proved minimally correct, and more soil was displaced as circumference widened. The distance from the tree to the sidewalk did not prove to reasonably affect how much soil was displaced. The species of tree planted proved significant as a large number of the same species were found to be detrimental. Also the majority of trees that did break sidewalk were already previously classified as having a high risk and the majority of passive trees were classified as having only a moderate risk.

Conclusions/Discussion
My conclusions are that trees with a larger circumference are more likely to have roots causing sidewalk damage. Trees that are planted nearby sidewalk do not play as much a significant role in determining the extent of damage. However a conclusive average was taken of the experimental group and trees should not be planted under three feet from neighboring sidewalk. The species of tree plays a vital role in damage prevention, and a list of the best and worst trees to plant in an urban environment was established.

Summary Statement
My study focuses on the conditions and trends of trees destroying sidewalks.

Help Received
San Diego Forester Drew Potocki helped identify trees

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Zachary A. Lute

Project Number
S0807

Project Title
Study on Anionic Polyacrylamides

Abstract

Objectives/Goals
This experiment was conducted in order to find the effects of different concentrations of two anionic Polyacrylamides, Amber 1200 and Stockopam, on water infiltration and flocculation in Chualar sandy loam soil.

Methods/Materials
In order to determine this, two polyacrylamides (PAMs) were presented from different companies and the powder was mixed with water to form a diluted solution for the experiment. In order to dilute the polyacrylamides from 100ppms to 10, 5, and 1ppm, the equation C(1) X V(1) = C(2) X V(2) was used. Chualar sandy loam soil was placed in the small column of Merit Burettes and the tall column was filled with the polyacrylamides Amber 1200 and Stockopam in different concentrations. Measurements of how fast the two liquids passed through the tall column to the short column and into the soil were done in 5cm increments.
The procedure for measuring the flocculation of run-off was then conducted. For this, 7 small cylinders were filled with the soil and the solutions were placed into the cylinders and they were shaken and let sit before the solution was removed and placed into a machine called a UV/Vis Spectrophotometer that shot light through the center of the cell and measured the suspended sediment.

Results
The results indicate that Stockopam was much more effective in flocculating the sediment and only minimally reducing water infiltration.
More research is being done but is not yet conclusive. Stockopam and Amber 1200 at all of the concentrations are in the process of being tested to see their effect on the flocculation of Phosphate and Nitrates.

Conclusions/Discussion
Stockopam ended up reducing sediment significantly at the low concentration of 1ppm (Fig.4) while only slightly hindering water infiltration by running at only 4min and 20sec slower than fresh tap water (Fig.2,1). So the hypothesis was partially correct because one of the anionic polyacrylamides increased flocculation and only slightly reduced infiltration in the sandy loam soil. The other, however, only greatly impaired the infiltration and had little effect on the flocculation rate.

Summary Statement
The effects of the molecule Polyacrylamide on water infiltration and the reduction of sediment, phosphorus, and nitrates in tailwater.

Help Received
The facilities at the USDA were used along with their lab equipment under the supervision of Dr. Husein Ajwa and Dr. Susane Klose from UC Davis.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
David I. Marash-Whitman

Project Number
S0808

Project Title
Design for Biodegradation: Harnessing Natural Decay by Managing Physical and Chemical Dynamics

Abstract

Objectives/Goals
The goal of this project was to determine how key physical and chemical parameters such as carbon:nitrogen ratio, moisture, and aeration, affect biodegradation efficiency and decomposition rates for organic material, impacting our ability to recycle organics and reduce the amount sent to landfills.

Methods/Materials
To assess biodegradation efficiency, small bioreactors were constructed for composting samples with varying carbon:nitrogen ratio, moisture, and aeration design (9 variations with duplicates per run, replicate runs). Temperatures produced were measured by probing samples in 3 mid-pile locations 3-5 times daily. To look at decomposition rates of organic samples, oxygen uptake and therefore CO2 emission was measured by monitoring liquid displacement in custom-built constant pressure respirometers.

Results
Optimum carbon:nitrogen ratio was 30:1, a lower ratio (20:1, increased nitrogen) resulted in a 41% drop in averaged net temperature, and a higher ratio(40:1,increased carbon) resulted in a 51% drop. Measured CO2 emission rates were up to 8 times higher for organics high in nitrogen during initial decomposition, and 4 times higher for optimum moisture (55%) versus high moisture (70%). A 55% initial sample moisture produced optimum average temperatures, 40% sample moisture had average temperatures 21% lower, and 70% sample moisture produced average temperatures were 56% lower. Low to medium aeration design yielded optimum results, with high aeration reducing the net temperatures by 56%.

Conclusions/Discussion
Results stressed the need to design for efficient biodegradation by showing very significant drops in temperature, produced by composting systems with design parameters deviating from the extracted optimums. Samples too high in nitrogen had high initial decomposition rates consistent with steep ramp-up to peak temperature, but were unable to maintain their high temperature probably because not enough carbon was available to support rapid bacteria growth. The higher moisture level (~70%) slowed biodegradation down by a great amount, probably because the excess moisture not only inhibited the decomposition rate, but also cooled down the decomposing samples. Results for optimum aeration showed that contrary to popular opinion, low to medium aeration yielded similar results, while high aeration had a very negative impact on the system, probably because of cool air it introduced.

Summary Statement
This research work determined the impact of several key parameters that should be managed to improve the efficiency of the biodegradation process of organic waste.

Help Received
I consulted with LabPro staff, Renee Jacowitz, and my mother on materials and measurement techniques. My mother helped me acquire materials.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Noah J. McCormack

Project Number
S0809

Project Title
Nitrate Concentrations in Effluents to the Monterey Bay Sanctuary

Abstract

Objectives/Goals
Determine if implementation of State of California Senate Bill No. 923 has resulted in causing lower nitrates in agricultural effluents into the Monterey Bay Sanctuary.

Methods/Materials
Data collection prior to (from part of my study of 2004) and after passage of this legislation with water samples analyzed for nitrate concentrations in effluents collected in the Salinas Valley Reclamation Ditch during the winter rainy season. This data will also be compared to historic data from the Citizen's Watershed Monitoring Network program. This ground breaking community based volunteer effort to annually measure chemical concentrations in watersheds started as the First Flush Program in Monterey and has expanded to the California coast.

Results
Agricultural run-off analyzed for nitrate concentrations in effluents collected in the Salinas Valey Reclamation Ditch at two locations (Salinas and Castroville) were significantly higher than 2004. The actual concentrations were ten times normal water concentrations. The results show no reductions as predicted by the legislation or industry sources.

Conclusions/Discussion
Claims by the agriculture industry made in an editorial in the Monterey County Herald daily newspaper on November 30, 2004, that voluntary implementation of farm practice to minimize run-off into the Montery Bay Sanctuary are unfounded and not producing improvements in effluent water quality during the rainy season. Observed levels of nitrates for 2005 increased over 2004, to approach or exceed action levels set by the Central Coast Ambient Monitoring Program (CCAMP). This study verifies my inital study of 2004, establishing a data base of unacceptable nitrate concentrations that have the potential to harm wildlife, human community and ocean ecology.

Summary Statement
Are agricultural effluents collected in the Salinas Valley Reclamation Ditch affecting the Monterey Bay Sanctuary?

Help Received
Used lab equipment at Stevenson School under the supervision of Dr. A Galindo

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Nancy Nasrawin

Project Number
S0810

Project Title
Acidifying the Ocean

Abstract

Objectives/Goals
My experiment attempted to answer the question #Do varying pH levels affect shelled creatures in the ocean?# Through my research I discovered that the ocean#s pH level was 8.3 and is now about 8.1 and that it is predicted to continue dropping. In addition, acidity can dissolve calcium carbonate, which is what composes seashells. I hypothesized that if the pH level of a solution is acidic then the mass of carbonate seashells will slowly decrease.

Methods/Materials
In my experiment hydrochloric acid and a calcium carbonate solution were used to adjust the pH level of tap water. Nine different solutions were produced with the following pHs: 4.0, 5.0, 6.0, 7.9, 8.1, 8.3, 8.7, 8.9, 9.9. Nine groups of the same ten different shells for each solution were weighted. Each group of shells was then placed inside one of the solutions within closable containers. Every week for 5 weeks the shells were dried and weighed and results recorded.

Results
The 4.0 solution produced the greatest decrease: an average of .49 grams. Four out of the six basic solutions had less than half the loss of the most acidic solution. The pH of 8.3 had a .14 gram average decrease, 8.7 had a .17 gram average decrease, and the 8.9 and 9.9 both had an .18 average decrease.

Conclusions/Discussion
Carbon dioxide emissions cause acid rain, which is lowering the pH of the ocean. An unthought of consequence of burning fossil fuels is that it could thin the shells of creatures in the ocean, and could impede their ability to create a protective cover. Populations of seashell animals in the ocean could be expected to decline.

Summary Statement
My project is about the consequences of carbon dioxide emissions acidifying the ocean.

Help Received
Teacher set up equipment for me so I can adjust the pHs.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Shelley Patel; John Scott; Shivani Softa

Project Number

S0811

Project Title

The Pollution Solution: Why Ozone Levels May Thwart the Governor's Plan to Reduce Air Pollution in San Joaquin Valley

Abstract

Objectives/Goals

This project is a second-year study of an investigation initiated to develop basic methods of prediction for ozone concentrations. This year, we applied our new methods to one of Governor Schwarzenegger's plans. California will lose federal highway funds if it does not cut total air pollution in half by the year 2010; Governor Arnold Schwarzenegger has created a plan to help California meet its goal. We wanted to find out if ground ozone levels were entirely dependent on humans. We hypotheszied that ozone concentrations follow a natural cycle and can be predicted.

Methods/Materials

In our first method, we created three equations based on temperature and ozone readings from an air quality station in Bakersfield. Our second method was the "type curve" method; we found a direct correlation between temperature, time of year, time of day, and ozone levels, and we were able to create a graph that showed this. Both the first and second methods allowed us to predict ozone on a day-to-day basis. Our thid method was based on the sine curve pattern of ozone concentrations over 20 years. This method allowed us to ignore temperature data and predict ozone trends for up to ten years.

Results

Both the "equation" and "type curve" methods helped us prove one of our main hypotheses correct: The recommendation to abstain from exercise between hours of nine a.m. and six p.m. is not necessarily correct or applicable to all areas at all times of the year.

Using method three, we found that ozone levels will be centering around a higher average in years to come. This proved that ground ozone levels aren#t entirely dependent on humans; natural cycles influence these levels greatly.

When it came to our thoughts about global warming, however, we were wrong. By simply doing a few calculations on a TI-83 calculator, we were able to find that the temperature would only increase by a tiny fraction by 2010, and thus not affect the ozone levels significantly.

Conclusions/Discussion

The resulting amplitude, frequency, and center that we found helped us plot a sine curve, which showed us how ozone levels followed a natural cycle. Though ozone does depend on factors such as temperature and traffic counts, it is possible to predict levels over a period of several years based entirely on the natural cycle of ozone.

Summary Statement

Based on temperature data, we were able to predict future ozone concentrations; an analysis of ozone trends from 1980-2001 led us to conclude that ozone levels follow a natural cycle.

Help Received

Dr. Deborah Dreschler gave us ozone readings in the San Joaquin Valley; representative of Caltrans helped us learned about Governor Arnold Schwarzenegger's plan to create a #Hydrogen Highway;# Phiroze Patel helped us with any problems we had with Microsoft Excel.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Vanessa Peralez

Project Number
S0812

Project Title
Water Conservation: What Can People Do to Conserve Water and Avoid Wet/Dry Spots

Abstract

Objectives/Goals
The goal is to help people understand just how much water their sprinkler system is affectively applying to their lawn, based on precipitation rate (net) and distribution uniformity. With this knowledge maybe they will be encouraged to perform an irrigation audit on their sprinkler system. This would help minimize runoff and conserve water while eliminating wet/dry areas.

Methods/Materials
A method of checking an irrigation system for net precipitation rate, distribution uniformity and efficiency is by performing an irrigation audit. An audit is a series of field tests procedures for collecting data (capturing water). This data was then put on an area test map for quick reference showing location of 30 catch devices and the amount of water capture in each catch device, location of sprinkler heads and duration of test (runtime).

Materials:
Pressure regulator, Catch devices, flags, time clock, Clipboard, Pen & paper

Results
After performing two audits, one at 30 p.s.i. and one at 60 p.s.i. the visual observations was that the water spraying out from the sprinkler nozzles were in the form of droplets and the water from the 60 p.s.i. was in the form of mist. Calculations showed that the lower pressure setting (30 p.s.i.), had better net precipitation rate (4.26 in / hrs) and distribution uniformity (76%) than that of the higher pressure setting. This means the water is being distributed more uniformity throughout the area to help eliminate wet /dry spots. Also knowing the precipitation rate can help when estimating run time, minimize runoff and conserve water.

Conclusions/Discussion
My conclusion agreed with my hypothesis, if people were to perform an irrigation system audit on their sprinkler system, they most likely will find they could do alterations to their system to lower the amount of water used and still keep a healthy landscape while keeping runoff to a minimum.

Summary Statement
Water conservation and how it relates to the distribution uniformity of an irrigation lawn system.

Help Received
Grandfather helped set the sprinkler system pressure regulator for audits first at 60 psi then at 30 psi.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
James Robillard

Project Number
S0813

Project Title
Dusty Problem Misty Solution: The Design and Testing of a PM-10 (Particulate Matter) Suppressant

Abstract

Objectives/Goals
The project's purpose tested a new way to suppress anthropogenic atmospheric PM-10 with water. I believe that a spray device attached to a farm disc with proximal water delivery could reduce PM-10 below the standards set by the nation and the State of California. This device would be an affordable, efficient, solution to soil erosion, and health problems, while significantly improving air quality and visibility.

Methods/Materials
In the experiment, PM-10 was introduced, in the form of baby powder, 5.08 cm above the base of a self designed 61 cm cylinder. On the contra lateral of the cylinder, water was sprayed from five different heights. PM-10 and the water were simultaneously introduced, spraying for three seconds. The PM-10 was allowed to settle for ten seconds. At the base of the cylinder, pre-massed filter-paper was used to collect the PM-10 and water that returned to the ground. The water was allowed to evaporate for 24 hours. Once dried, the amount of PM-10 collected was re-weighed.

Results
The most effective heights for PM-10 abatement were 19.05 and 29.21 centimeters. At these heights the spray device was 26.7% most effective in reducing PM-10 pollution. Results here suggest an onboard device where a proximal delivery of water may significantly reduce the amount of PM-10 being emitted by farm equipment. When this measured 26.7% reduction is applied to data provided by the California Air Resources Board, PM-10 could safely fall within national and California State standards.

Conclusions/Discussion
PM-10 triggers asthma attacks, weakens crops, and contributes to Valley Fever. PM-10 is a main component of air pollution, and has been implicated as one factor in air-quality related deaths. A spray device can have significant and immediate effects in areas of high agricultural activity, such as the San Joaquin Valley. A device with the advantage of onboard proximal water delivery could reduce health problems with improved air quality and visibility.

Summary Statement
This project tests a way to efficiently reduce PM-10 with water, in an effort to improve air quality, reduce soil erosion, health problems, and unnecessary premature deaths caused by the particles.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Jennifer So; Monica So

Project Number

S0814

Project Title

Phase V: Cost-Effective and Pollution-Free Natural Recycling of Impure Water

Abstract

Objectives/Goals

The objective was to develop a method to naturally recycle impure water in an economic, environmentally friendly, easily maintainable, and efficient process.

Methods/Materials

Three identical water recycling models were constructed, each consisting of a water unit, a condenser unit, a final water collection unit, and a heat source unit. Before inputting a contaminated, undrinkable water source into the water compartment, the resistance, concentration, pH, and chemical content were recorded. The recycling systems were then placed outside in an area exposed with ample sunlight. Temperature recordings were made during the morning, afternoon, and evening. During the evening, the total water condensation produced was measured with a scale. After a ten-day trial period, the final resistance, pH, concentration, and chemical content were recorded. The entire process was replicated with pond water samples, followed by a distilled water sample, which acted as the control.

Results

Although there was not a high efficiency rate, the effectiveness of separating the impurities from the original impure water samples was apparent. Through the analysis of pH, concentration, resistance, and chemical tests, the resulting water samples, produced from the recycling model systems, indeed had results closely similar to the pH, resistance, concentration, and chemical content of distilled water.

Conclusions/Discussion

Even though we had improved means of insulation for the models, the efficiency was low because there was not adequate energy input from the environment. The total amount produced was 225.7g of water, which was drinkable. The experiment cost under $40, produced no pollution, ran on natural energy, and was easily maintainable. Further modifications are to implement mirrors to increase the amount of energy input and to utilize fiberglass to conserve heat for the heat compartment of the recycling models.

Summary Statement

In place of artificially driven water treatment processes, our water recycling models utilize naturally induced temperature changes to recycle water through a pollution-free, modestly maintainable, and economic method.

Help Received

Our parents provided helpful suggestions to improve our project and models, purchased model and board materials, and were our main source of support for this project. Our science teachers also provided useful tips and equipment to analyze our water samples.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Paul A. Westhart

Project Number
S0815

Project Title
The Effect of Pseudomonas putida Bacteria in Promoting the Rhizosphere Biodegradation of Oil-Contaminated Soil

Abstract

Objectives/Goals
The objective of my experiment is to determine if Pseudomonas putida bacteria can enhance the natural phytoremediation of oil-hydrocarbon contaminated soil by increasing the microbial population in the rhizosphere.

Methods/Materials
Prepare 10 pots containing 1kg of potting soil, gravel, & fertilizer each. Add 1500 mg of refined oil to each pot. Separate the pots as follows:
> 2 pots with tomato plants in oil contaminated soil (control)
> 2 pots with alfalfa plants in oil contaminated soil (control)
> 3 pots with tomato plants in oil-contaminated soil inoculated with 40 ml of Pseudomonas putida bacteria culture
> 3 pots with alfalfa plants in oil-contaminated soil inoculated with 40 ml of Pseudomonas putida bacteria culture

Measure the pH of each soil sample 5 times during the investigation. Count the bacterial population in each soil sample 3 times during the experiment by using dilution and plating-out procedures In week four, add previously weighed earthworms in groups of five to each pot to test the toxicity of the soil. At the end of week six, measure the weight of the earthworms and test the concentration of oil in the samples using method 418.1.

Results
All the measurements indicate that hydrocarbon concentrations were lower by the end of the experiment in the pots containing plants and soil inoculated with Pseudomonas putida when compared to the controls. The Alfalfa sample with Pseudomonas worked best at removing hydrocarbons from the soil.

Conclusions/Discussion
The results support the hypothesis that the bacteria Pseudomonas putida promotes the rhizosphere bioremediation of oil contaminated soil by increasing the composition of the microbial community. The symbiotic relationship between the soil microbes and Pseudomonas may be responsible for the degradation of oil contaminants.

Summary Statement
My project tests the effect of Pseudomonas putida bacteria on the rhizosphere bioremediation of oil-contaminated soil.

Help Received
My parents helped me obtain the necessary materials. Many thanks to Mr. Richard Fosyth of Sierra Analytical for testing the oil concentration in my samples without charge using method 418.1.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Justin W. Woo

Project Number
S0816

Project Title
Viability of M. californianus to Control Nutrient Levels in Algal Blooms

Abstract

Objectives/Goals
To determine how California Mussels affect nitrate and phosphate concentrations in ocean water, with specific regards to algal blooms and eutrophication.

Methods/Materials
30 Mytilus californianus mussels, 1 spectrophotometer, 2 HACH nitrate/phosphate reagent testing kits, 2 bottles-100 mg/L nitrate/phosphate solutions, 30 cuvettes, pipettes, timer, beakers, filtered sea water, insulated cooler.

Create 3 nitrate solutions and 3 phosphate solutions, one of each at: 5mg/L, 4mg/L, and 3mg/L with HACH Standard Solutions. At each concentration, create 5 identical beakers with 400-mL of nutrient solution. Place 4 mussels in the beakers, and leave the last one empty. Measure concentrations of phosphate or nitrate in water samples from all beakers twice every 10 minutes for 90 minutes. Do this by adding the HACH reagent liquid, which will turn the solution blue (phosphate) or red (nitrate). The shade of solution corresponds to nutrient concentration, and thus, place the colored solution in the spectrophotometer and record percent transmittance. Zero out and calibrate the spectrophotometer in order to convert from transmittance to mg/L, then repeat procedures for all other concentrations.

Results
Nitrate levels decreased 70-80% (mean=2.7mg/L), while phosphate levels decreased 45-55% (mean=1.2mg/L). The varying starting concentrations yielded the same patterns in both nitrate and phosphate. The graph of nutrients present in solution over time has a negative slope. Linear regression t-tests yielded P-values less than 0.01, thus confirming the consistency of the data over time.

Conclusions/Discussion
Algal blooms are mainly caused by an overabundance of nitrate and phosphate. Thus, California Mussels are a viable way to improve nutrient levels and prevent algal blooms. Their filter-feeding capabilities also lends them to combat eutrophication directly. Calculations show that 2000 mussels in a 1-million gallon body of eutrophic water can decrease nutrient levels by 50% in less than 2 years. However, such large-scale implementations would have to first be applied in a simulated environment to assess the impact of a mussel population on surrounding water life.

Summary Statement
My project tested the effects that California Mussels have on nitrate and phosphate concentration levels in ocean water, with regards to algal blooms and eutrophication.

Help Received
Mr. Paul Hunt (Villa Park HS Biology Teacher) allowed me to use his classroom for my workspace and also allowed me to use all of his equipment for my experimentation.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Megan S. Yoo

Project Number

S0817

Project Title

Wanted: Safe and Healthful Water -- No Strings Attached (Phases II and III)

Abstract

Objectives/Goals

The objective of Phase II was to determine the effect of temperature on the formation of trihalomethanes (THMs). The experiments in Phase III were conducted to utilize the factors in the formation of THMs found in Phases I and II to determine an effective method of THM removal using filters that were either hand-made or commercially processed.

Methods/Materials

For Experiment 1, water samples from 6 sources were spiked with 3 ppm of NaOCl and were stored at either 4 or 20 deg. C, to note the trend in THM formation based on temperature. Experiment 2 tested the effectiveness of coconut carbon, graphitized non-porous carbon, and a styrene divinylbenzene polymer base in the removal of THMs by filtering water spiked with 80 ppb of THMs. In Experiment 3, 8 hand-made filters, created using various types of adsorbents/absorbents, along with 5 commercially made filters, were tested for efficiency in the removal of THMs at pH levels of 4, 7, and 11. In Experiment 4, tests for the two most efficient filters from Experiment 3 were confirmed by filtering 8 types of water spiked with 80 ppb of THMs. The GC/MS was used to analyze the type and quantity of the THMs using 40mL samples. To ensure that the results for the THM analysis were accurate, a calibration curve was created using various concentrations of the THM standard on the GC/MS, and the ratios of the fluorobenzene internal standard were periodically checked. A total of 288 samples were tested, in addition to 0 ppb, 2 ppb and 10 ppb standards that were used to continuously check the calibration of the system.

Results

The samples stored at 20 deg. C formed more THMs in Experiment 1. Coconut carbon, recommended by the EPA for the removal of NDMA, proved to be the most successful in the removal of THMs. The styrene divinylbenzene polymer base was also quite effective in removing THMs, but it yielded a byproduct of benzene.

Conclusions/Discussion

THM formation is directly related to temperature and can successfully be eliminated using filtration by coconut carbon. THMs, especially chloroform, are easily produced in many water sources after chlorination. Known as toxins, significant amounts of THMs (over 60 ppb) can also cause large sores, and they have been linked to bladder, colon, and rectal cancer, diseases in the kidney, liver, lung, and nervous system, as well as miscarriages. Both hard chlorine tablets and liquid forms of chlorine can cause THM formation in water.

Summary Statement

Trihalomethane formation is positively associated with temperature, in addition to the incubation period and the presence of organic content and chlorine, and THMs could effectively be eliminated through the use of coconut carbon filters.

Help Received

I received prior training on running and interpreting the GC/MS from Supervising Chemist Lee J. Yoo during the past four years. Lab work for detection of trihalomethanes was done in the organic laboratory of OCWD under the supervision of Lee J. Yoo.

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)

Rachel Knight; Erin Schluter

Project Number

S0898

Project Title

Iron Fertilization and Eutrophication of Phytoplankton on Dissolved Oxygen Content

Abstract

Objectives/Goals

The goal was to test the affects of increased phytoplankton growth due to iron fertilization on the amount of dissolved oxygen below the water surface of an ocean environment. Numerous experiments have already proven iron fertilization increases phytoplankton populations, but these tests failed to study the side affects of such fertilization on the environment near the bottom of the testing area. The experimental hypothesis was that if the iron concentration in ocean water is increase, then the oxygen below the surface will decrease because of eutrophication and replacement of oxygen by carbon dioxide.

Methods/Materials

Four identical systems were constructed to mimic certain ocean conditions (light gradient, oxygen gradient, salt content) and to allow for testing at a substantial depth. After an initial stabilizing period, a plankton concentrate was added to each of the four systems and allowed time to establish. Ferrous sulfate was added to three of the tubes in different amounts. One system, the control, received no iron. The four environments were titrated over a five month period for dissolved oxygen content.

Results

For the first phase of the experiment, the collection design was flawed and most of the data is inconclusive. However, after the collection method was corrected, the four tubes had an equal amount of dissolved oxygen before the iron was added. After the iron was added, the dissolved oxygen in the tube with the 0.1g of ferrous sulfate for 3.2L saltwater increased greatly while the other systems, including the control with no iron decreased slightly. During the second test, the DO concentration of the control and the systems with the two highest iron concentrations remained constant. (Constant based on measurable change. The color of the solution to be titrated indicated a slight decrease in both systems.) The system with 0.1g ferrous sulfate increased in DO content.

Conclusions/Discussion

The results do not support the hypothesis fully. The higher iron concentrations did decrease DO content observably but not measurably. From our experiment, it appears there is an optimal amount of iron to promote dissolved oxygen in the ocean. The implications of these results are great. If there is an optimal level of iron concentration to increase phytoplankton and dissolved oxygen, then iron fertilization could be safe and affective to help reduce global warming and increase fish populations.

Summary Statement

The experiment tested the affects of iron fertilization of phytoplankton on deep-ocean dissolved oxygen content, with a focus on environmental safety.

Help Received

Kent Schulter for supplies and board construction; Centennial High School chemicals and lab space; Kristin Hudlow for lighting instruction and microscopes

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
Naomi R. Sussman

Project Number
S0899

Project Title
Disinfecting Duck Poop

Abstract

Objectives/Goals
My objective was to prove two things: the effects of the filtering and screening processes standard in sewage disinfection plants, and the best disinfecting agents used in treating the water. I hypothesized that A) If sewage goes through treatment, then 1) the bacterial colonies will decrease and 2) the turbidity will decrease.B) If chlorine, UV light, ozone, and iodine are tested for success in disinfecting sewage, then chlorine will be the most effective because it is a proven disinfection method that I have observed.

Methods/Materials
In this experiment, there were five base steps: 1) the settling of the effluent in a bucket, 2) the screening of the effluent through two screens of varying mesh size, 3) the filtering of the sewage through coffee filters in a funnel, 4) the oxygenating of the effluent with an aquarium pump for twenty-four hours, and 5) disinfection. There were four disinfecting media: ozone, chlorine, iodine, and boiling. After these procedures were followed, the samples were plated and inoculated into culture tubes to evaluate the results. The plates were a visual representaion of the bacterial growth, and the tubes measured the turbidity due to bacterial growth by way of strips with five bars of varying degrees of darkness. The more bars that could be observed, the less bacterial growth there was in the solution.

Results
The most turbid solutions by measure of the turbidity meters were the samples form stages yet to be disinfected. The least turbid solutions by measure of the turbidity meters were the boiling and chlorination samples. My results in the culture tubes were backed by similar growth results in the plates.

Conclusions/Discussion
I observed that the sediment did decrease after each stage. I conclude from these results that my hypothesis was correct in stating that chlorine would be the most effective disinfectant observed that the sediment did decrease after each stage.

Summary Statement
Disinfecting Duck Poop was designed to find the effectivness of standard treatment processes and disinfection media.

Help Received
My father helped come up with the idea; my mother helped collect suppliesl; my biology teacher, Ms. Moule, allowed me use of lab facilities.